9th Class 2017

Math (Science)	Group-I	Paper
Time: 2.10 Hours	(Subjective Type)	Max. Marks:

(Part-I)

2. Write short answers to any Six (6) questions: 12

(i) Define symmetric matrix.

Ans A square matrix A is symmetric if it is equal to its transpose, *i.e.,*

$$A^t = A$$

(ii) Find the value of a, b, c and d which satisfy matrix equation:

$$\begin{bmatrix} a+c & a+2b \\ c-1 & 4d-6 \end{bmatrix} = \begin{bmatrix} 0 & -7 \\ 3 & 2d \end{bmatrix}$$

Ans By comparing, we get

$$a + c = 0 \quad \text{(i)}$$
$$a + 2b = -7 \quad \text{(ii)}$$
$$c - 1 = 3 \quad \text{(iii)}$$
$$4d - 6 = 2d \quad \text{(iv)}$$

From (iii),

$$c - 1 = 3$$
$$c = 3 + 1$$
$$c = 4$$

Put c in (i),

$$a + 4 = 0$$
$$a = -4$$

Put a in (ii),

$$-4 + 2b = -7$$
$$2b = -7 + 4$$
$$2b = -3$$
$$b = \frac{-3}{2}$$

From (iv),

$$4d - 2d = 6$$
$$2d = 6$$
$$d = 3$$

(iii) Simplify: $(x^3)^2 \div x^{3^2}$

Ans

$$(x^3)^2 \div x^{3^2} = x^6 \div x^9$$

$$= \frac{x^6}{x^9}$$
$$= x^{6-9}$$
$$= x^{-3}$$
$$= \frac{1}{x^3}$$

(iv) Find the value of: $\quad i^{27}$

Ans $i^{27} = i \,.\, i^{26}$
$$= i \,.\, (i^2)^{13}$$
$$= i(-1)^{13}$$
$$= i(-1)$$
$$= -i$$

(v) Express in ordinary notation: $\quad 9.018 \times 10^{-6}$

Ans $9.018 \times 10^{-6} = \frac{9.018}{10^6}$
$$= \frac{9.018}{1000000}$$
$$= 0.000009018$$

(vi) Evaluate: $\quad \log_2 \frac{1}{128}$

Ans Let $x = \log_2 \frac{1}{128}$
$$2^x = \frac{1}{128}$$
$$2^x = \frac{1}{2^7} \quad \Rightarrow \quad 2^x = 2^{-7}$$
$$x = -7$$

(vii) Reduce to lowest form: $\quad \frac{8a(x+1)}{2(x^2-1)}$

Ans $\frac{8a(x+1)}{2(x^2-1)} = \frac{8a(x+1)}{2(x+1)(x-1)}$
$$= \frac{4a}{x-1}$$

(viii) Simplify: $\quad \sqrt{21} \times \sqrt{7} \times \sqrt{3}$

Ans $\sqrt{21} \times \sqrt{7} \times \sqrt{3} = \sqrt{21 \times 7 \times 3}$
$$= \sqrt{3 \times 7 \times 7 \times 3}$$

$$= \sqrt{3^2 \times 7^2}$$
$$= 3 \times 7$$
$$= 21$$

(ix) Factorize: $x^2 + x - 132$

Ans $x^2 + x - 132 = x^2 + 12x - 11x - 132$
$$= x(x + 12) - 11(x + 12)$$
$$= (x - 11)(x + 12)$$

3. Write short answers to any Six (6) questions: 12

(i) Find H.C.F. : $102xy^2z, 85x^2yz$

Ans Factors of $102xy^2z = 2 \times 3 \times 17 \times x \times y \times y \times z$

Factors of $85x^2yz = 5 \times 17 \times x \times x \times y \times z$

Common Factors $= 17, x, y, z$

$$\text{H.C.F} = 17xyz$$

(ii) Define linear equation.

Ans A linear equation in one unknown variable x is an equation of the form $ax + b = 0$, $a, b \in R$ and $a \neq 0$.

(iii) Solve the equation: $|3x - 5| = 4$

Ans

$3x - 5 = 4$	$3x - 5 = -4$
$3x = 4 + 5$	$3x = -4 + 5$
$3x = 9$	$3x = 1$
$x = \frac{9}{3}$	$x = \frac{1}{3}$
$x = 3$	

(iv) Define origin.

Ans If in a plane two mutually perpendicular lines are drawn, then their point of intersection is called origin.

(v) Find the values of m and c of the line $2x - y = 7$ expressing it in the form $y = mx + c$.

Ans Given line:
$$2x - y = 7$$
$$2x - 7 = y$$
$$\Rightarrow \quad y = 2x - 7$$

Here, $\boxed{m = 2}$, $\boxed{c = -7}$

(vi) Find the distance between the points: $A(2, -6), B(3, -6)$

Ans The given points are:
$$A(2, -6), B(3, -6)$$

The distance formula is:
$$d = |AB| = \sqrt{(3 - 2)^2 + (-6 + 6)^2}$$

$$= \sqrt{(1)^2 + (0)^2}$$
$$= 1$$

(vii) Find the mid-point of :
A(3, –11), B(3, –4)

Ans The given points are:

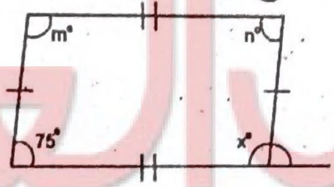
A(3, –11), B(3, –4)

$$M = \left(\frac{3+3}{2}, \frac{-11-4}{2}\right)$$
$$= \left(3, -\frac{15}{2}\right)$$

(viii) What is meant by S.S.S. postulate?

Ans In the correspondence of two triangles, if three sides of one triangle are congruent to the corresponding three sides of the other, then the two triangles are congruent. That is called S.S.S postulate.

(ix) Find the unknowns in the given figure:



Ans As in parallelogram, opposite angles are equal,

$\therefore$ $n = 75^\circ$ and $m^\circ = x^\circ$

Also, $x^\circ + m^\circ + n^\circ + 75^\circ = 360^\circ$

$$x^\circ + m^\circ + 75^\circ + 75^\circ = 360^\circ$$
$$x^\circ + m^\circ + 150^\circ = 360^\circ$$
$$x^\circ + m^\circ = 360^\circ - 150^\circ$$
$$x^\circ + m^\circ = 210^\circ$$

But $x^\circ = m^\circ$

$\Rightarrow$ $x^\circ + x^\circ = 210^\circ$

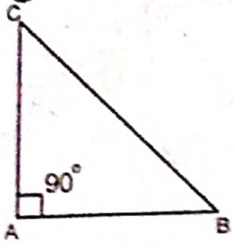
$$2x^\circ = 210^\circ$$
$$x^\circ = \frac{210^\circ}{2}$$
$$\boxed{x^\circ = 105^\circ}$$

And $\boxed{n^\circ = 75^\circ}$, $\boxed{m^\circ = 105^\circ}$

4. Write short answers to any Six (6) questions: 12

(i) Define right angled triangle and draw figure.

Ans A triangle in which one angle is right angle, i.e. (90°), is called a right angled triangle.



(ii) **The length of sides are 2 cm, 4 cm and 7 cm. Can a triangle be constructed? Explain.**

Ans As $2 + 4 < 7$

Thus triangle cannot be formed, because some of two sides of triangle is not greater than the length of third side.

(iii) **Define congruent triangles.**

Ans Two triangles are said to be congruent, if there exists a correspondence between them such that all the corresponding sides and angles are congruent.

(iv) **Define bisector of an angle.**

Ans Angle bisector is the ray which divides an angle into two equal parts.

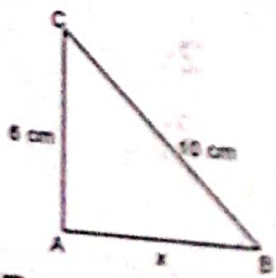
(v) **Verify that measures of sides of triangle are of right angle: a = 9 cm, b = 12 cm, c = 15 cm.**

Ans As $(Hyp)^2 = (Base)^2 + (Alt)^2$

$$(15)^2 = (9)^2 + (12)^2$$
$$225 = 81 + 144$$
$$225 = 225$$

$\therefore$ It is a right triangle.

(vi) **Find x in triangle:**



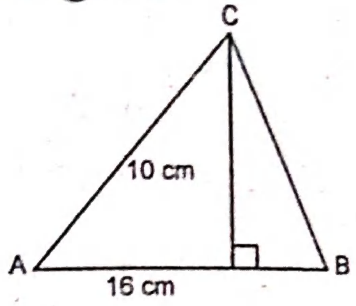
Ans As

$$(Hyp)^2 = (Base)^2 + (Alt)^2$$
$$(10)^2 = (x)^2 + (6)^2$$
$$100 = x^2 + 36$$
$$100 - 36 = x^2$$

$$x^2 = 64$$

$$\Rightarrow \quad x = 8 \text{ cm}$$

(vii) Find area of the figure:



Ans Area $= \frac{1}{2} \times \text{Base} \times \text{Height}$

$$= \frac{1}{2} \times 16 \times 10$$

$$= 80 \text{ cm}^2$$

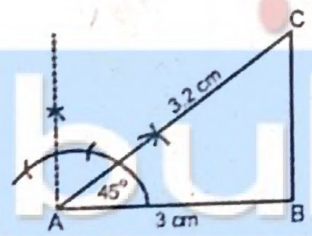
(viii) Define centroid of triangle.

Ans The point of concurrency of three medians of a triangle is called centroid of triangle.

(ix) Construct a ΔABC, in which:

$$m\overline{AB} = 3 \text{ cm}, m\overline{AC} = 3.2 \text{ cm}, m\angle A = 45^\circ$$

Ans



(Part-II)

NOTE: Attempt THREE (3) questions in all. But question No. 9 is Compulsory.

Q.5.(a) Solve the following system of linear equations by using Cramer's rule:

$$2x - 2y = 4$$

$$3x + 2y = 6$$

Ans In matrix form,

$$\begin{bmatrix} 2 & -2 \\ 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 6 \end{bmatrix}$$

$$AX = B$$

Here, $A = \begin{bmatrix} 2 & -2 \\ 3 & 2 \end{bmatrix}$

$$|A| = \begin{vmatrix} 2 & -2 \\ 3 & 2 \end{vmatrix}$$
$$= 2(2) - 3(-2)$$
$$= 4 + 6$$
$$= 10 \neq 0$$
$$|A_x| = \begin{vmatrix} 4 & -2 \\ 6 & 2 \end{vmatrix}$$
$$= 4(2) - 6(-2)$$
$$= 8 + 12$$
$$= 20$$
$$|A_y| = \begin{vmatrix} 2 & 4 \\ 3 & 6 \end{vmatrix}$$
$$= 2(6) - 3(4)$$
$$= 12 - 12$$
$$= 0$$
$$x = \frac{|A_x|}{|A|} = \frac{20}{10} = 2$$
$$y = \frac{|A_y|}{|A|} = \frac{0}{10} = 0$$
$$\{x = 2, y = 0\}$$

(b) Simplify: $\sqrt[3]{\dfrac{a^l}{a^m}} \times \sqrt[3]{\dfrac{a^m}{a^n}} \times \sqrt[3]{\dfrac{a^n}{a^l}}$ (4)

Ans $$\sqrt[3]{\frac{a^l}{a^m}} \times \sqrt[3]{\frac{a^m}{a^n}} \times \sqrt[3]{\frac{a^n}{a^l}} = \sqrt[3]{\frac{a^l}{a^m} \times \frac{a^m}{a^n} \times \frac{a^n}{a^l}}$$
$$= \sqrt[3]{a^{l-m} \times a^{m-n} \times a^{n-l}}$$
$$= (a^{l-m+m-n+n-l})^{1/3}$$
$$= (a^0)^{1/3}$$
$$= (1)^{1/3}$$
$$= 1$$

Q.6.(a) Use log tables to find the value of : (4)
$$\frac{(8.97)^3 \times (3.95)^2}{\sqrt[3]{15.37}}$$

Ans Let $$x = \frac{(8.97)^3 \times (3.95)^2}{\sqrt[3]{15.37}}$$
$$\log x = \log \frac{(8.97)^3 \times (3.95)^2}{\sqrt[3]{15.37}}$$

$$\log x = 3\log 8.97 + 2\log 3.95 - \frac{1}{3}\log 15.37$$

$$\log x = 3(0.9528) + 2(0.5966) - \frac{1}{3}(1.1867)$$

$$\log x = 2.8584 + 1.1932 - 0.3956$$
$$\log x = 3.656$$
$$x = \text{Antilog } 3.656$$
$$x = 4529$$

(b) If $m + n + p = 10$ and $mn + np + mp = 27$, find the value of $m^2 + n^2 + p^2$. **(4)**

Ans Given; $m + n + p = 10$

By taking square both sides, we get

$$(m + n + p)^2 = (10)^2$$
$$m^2 + n^2 + p^2 + 2(lm + mn + np) = 100$$
$$m^2 + n^2 + p^2 + 2(27) = 100$$
$$m^2 + n^2 + p^2 + 54 = 100$$
$$m^2 + n^2 + p^2 = 100 - 54$$
$$m^2 + n^2 + p^2 = 46$$

Q.7.(a) Factorize: $8x^3 + 60x^2 + 150x + 125$ **(4)**

Ans

$$8x^3 + 60x^2 + 150x + 125$$
$$= (2x)^3 + 3(2x)^2(5) + 3(2x)(5)^2 + (5)^3$$
$$= (2x + 5)^3$$

(b) Find the H.C.F. by division method: **(4)**

$x^4 + x^3 - 2x^2 + x - 3,\ 5x^3 + 3x^2 - 17x + 6$

Ans

$$5x^3 + 3x^2 - 17x + 6 \,\overline{)\, x^4 + x^3 - 2x^2 + x - 3 \,(}\; x + 2$$

$$\times 5$$

$$\cancel{5x^4} + 5x^3 - 10x^2 + 5x - 15$$
$$\pm \cancel{5x^4} \pm 3x^3 \mp 17x^2 \pm 6x$$

$$2x^3 + 7x^2 - x - 15$$
$$\times 5$$

$$\cancel{10x^3} + 35x^2 - 5x - 75$$
$$\pm \cancel{10x^3} \pm 6x^2 \mp 34x \pm 12$$

$$29x^2 + 29x - 87$$

$$29(x^2 + x - 3)$$

$$
\begin{array}{r}
5x - 2 \\
x^2 + x - 3 \overline{\smash{)}\, 5x^3 + 3x^2 - 17x + 6} \\
\pm 5x^3 \pm 5x^2 \mp 15x \\
\hline
2x^2 - 2x + 6 \\
\pm 2x^2 \pm 2x \mp 6 \\
\hline
0
\end{array}
$$

$$H.C.F = x^2 + x - 3$$

Q.8.(a) Solve the given equation: (4)

$$\frac{2}{x^2-1} - \frac{1}{x+1} = \frac{1}{x+1}\ ;\ x \neq \pm 1$$

Ans Given,

$$\frac{2}{x^2-1} - \frac{1}{x+1} = \frac{1}{x+1}$$

$$\frac{2-(x-1)}{x^2-1} = \frac{1}{x+1}$$

$$2 - x + 1 = \frac{1}{x+1}(x^2-1)$$

$$3 - x = x - 1$$

$$-x - x = -1 - 3$$

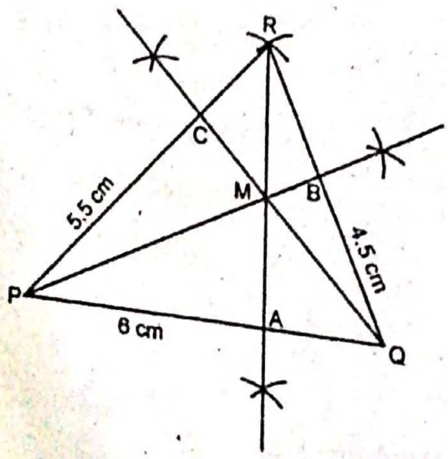
$$-2x = -4$$

$$x = \frac{-4}{-2}$$

$$x = 2$$

(b) Draw altitudes of ΔPQR, when $m\overline{PQ} = 6$ cm, $m\overline{QR} = 4.5$ cm and $m\,\overline{PR} = 5.5$ cm. (4)

Ans

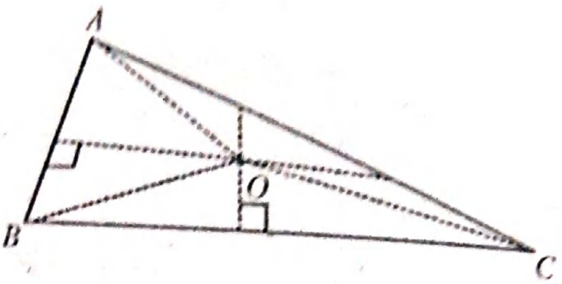


Steps of Construction:

1. Take PQ line as 6 cm long.
2. At point P, draw a 5.5 cm arc; and at point Q, draw 4.5 cm arc. Both of them cut each other at point R.
3. Join R with P and Q.
4. Then draw relevant altitudes of P, Q and R.
5. Thrice of these altitudes are the concurrent.

Q.9. Prove that the right bisectors of the sides of a triangle are concurrent.

Ans (8)



Given:

ΔABC.

To prove:

The right bisectors of $\overline{AB}$, $\overline{BC}$ and $\overline{CA}$ are concurrent.

Construction:

Draw the right bisectors of $\overline{AB}$ and $\overline{BC}$ which meet each other at the point O. Join O to A, B and C.

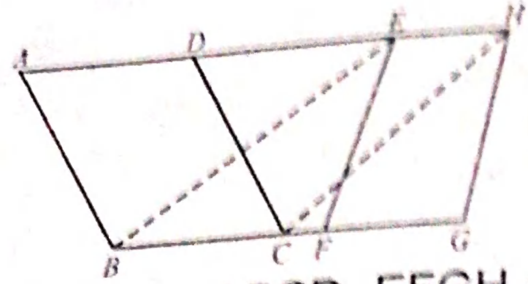
Proof:

Statements	Reasons
$\overline{OA} \cong \overline{OB}$ (i)	(Each point on right bisector of a segment is equidistant from its end points)
$\overline{OB} \cong \overline{OC}$ (ii)	As in (i)
$\overline{OA} \cong \overline{OC}$ (iii)	From (i) and (ii)
Point O is on the right bisector of $\overline{CA}$ (iv)	(O is equidistant from A and C).
of $\overline{AB}$ and of $\overline{BC}$ (v)	Construction
Hence the right bisectors of the three sides of a Δ are concurrent at 'O'.	From (iv) and (v)

OR

Prove that parallelograms on equal bases and having the same (or equal) altitude are equal in area.

Ans



Given: Parallelogram ABCD, EFGH are on equal bases $\overline{BC}$ and $\overline{FG}$, having equal altitudes.

To prove: Area of (parallelogram ABCD) = Area of (||gm EFGH).

Construction: Place the parallelograms ABCD and EFGH so that their equal bases $\overline{BC}$, $\overline{FG}$ are in the straight line BCFG. Join $\overline{BE}$ and $\overline{CH}$.

Proof:

Statements	Reasons
The given $\|^{gm}$ ABCD and EFGH are between the same parallels.	Their altitudes are equal. (Given)
Hence ADEH is straight line $\|$ to $\overline{BC}$	
$m\overline{BC} = m\overline{FG}$	Given
$= m\overline{EH}$	EFGH is a parallelogram.
Now $m\overline{BC} = m\overline{EH}$ and they are parallel.	
$\overline{BE}$ and $\overline{CH}$ are both equal and parallel.	
Hence, EBCH is a parallelogram.	A quadrilateral with two opposite sides congruent and parallel is a parallelogram.
Now $\|^{gm}$ ABCD = $\|^{gm}$ EBCH (i)	Being on the same base $\overline{BC}$ and between the same parallels.
But $\|^{gm}$ EBCH = $\|^{gm}$ EFGH (ii)	Being on the same base $\overline{EH}$ and between the same parallels.
Hence, area ($\|^{gm}$ ABCD) = Area (($\|^{gm}$ EFGH)	From (i) and (ii)